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NATIONAL DAM SAFETY PROGRAM. DRY RUN NUMBER 101 (ID NUMBER VA-1--ETC(U)
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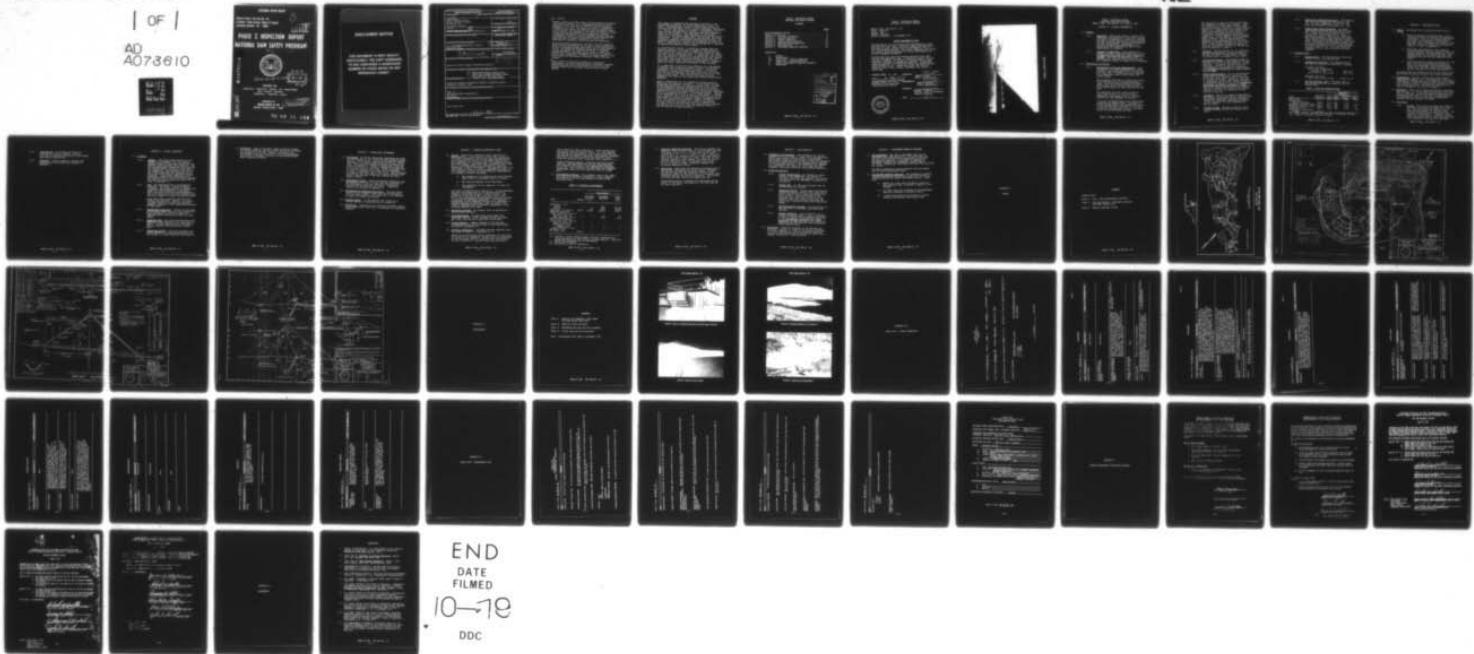
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DACW65-78-D-0016

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POTOMAC RIVER BASIN

Name of Dam: Dry Run No. 101

Location: Page County, State of Virginia

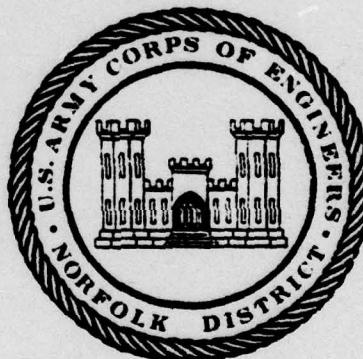
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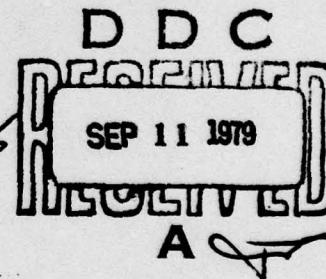
PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

See 1473 in back

ADA 073610



DACW 65-78-D-0016



PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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NAME OF DAM: DRY RUN NO. 101

ii

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Dry Run No. 101
State: Virginia
County: Page
Stream: Dry Run
Date of Inspection: 14 November 1978

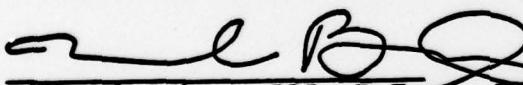
BRIEF ASSESSMENT OF DAM

Dry Run Dam No. 101 is an earth dam approximately 67 feet high and 2100 feet long. The dam is owned and operated by the Town of Luray, Virginia and was designed by the U.S. Soil Conservation Service. The visual inspection and review of as-built drawings indicate no serious deficiencies requiring emergency attention.

The spillway will pass the Probable Maximum Flood (PMF) without overtopping the dam. A stability analysis was not available; however, no evidence of distress due to slope stability problems or seepage was observed. Recommended remedial measures to be scheduled during the annual maintenance program are to: remove any large logs from the reservoir area, repair several footpaths, and install a staff gage.

MICHAEL BAKER, JR., INC. SUBMITTED:

Original signed by
JAMES A. WALSH


Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

RECOMMENDED:

James A. Walsh
Chief, Design Branch
Original signed by
ZANE M. GOODWIN

Zane M. Goodwin
Chief of Engineering by:

APPROVED:

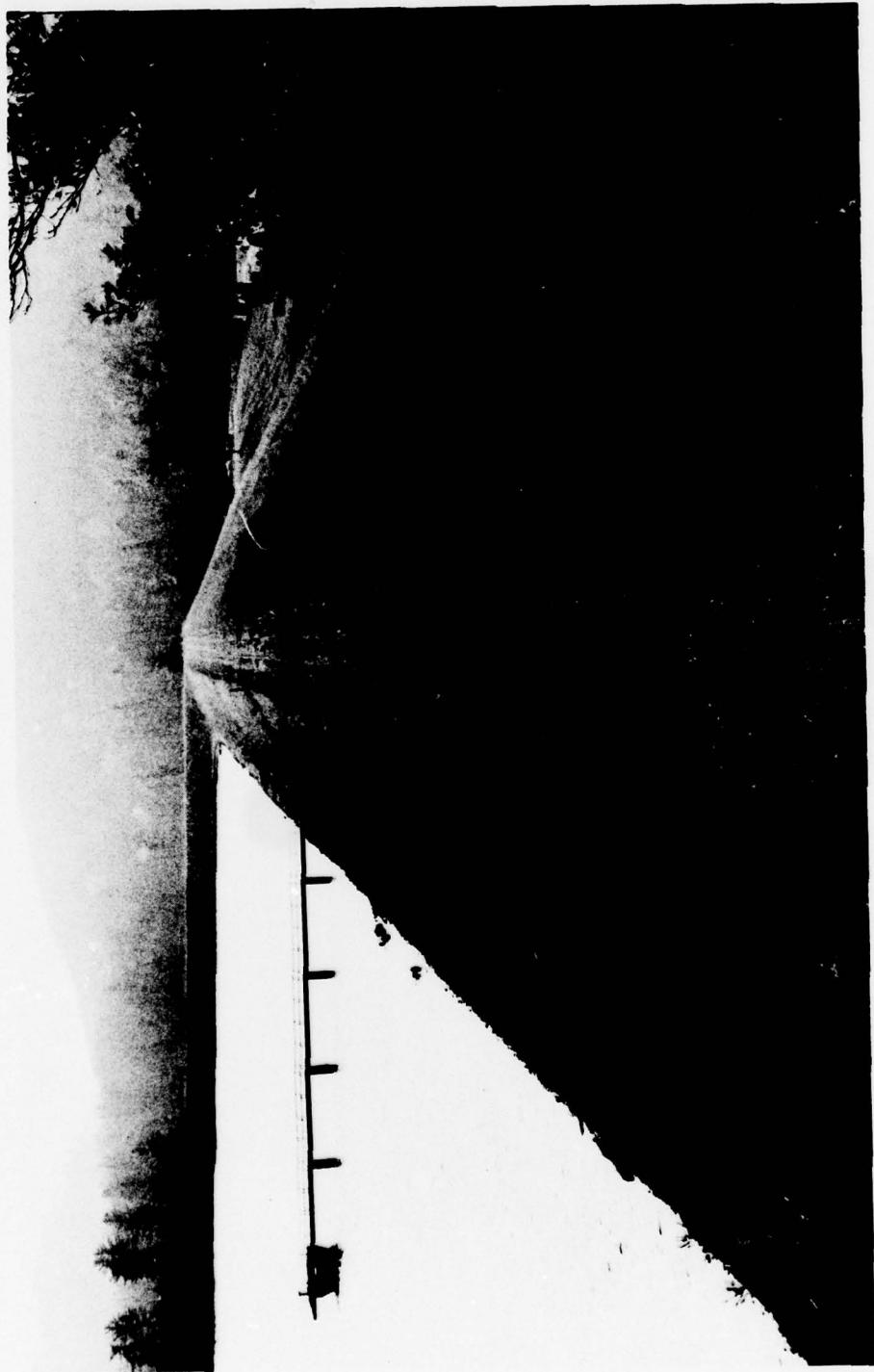
Douglas L. Haller
Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date:

FEB 4 1978



NAME OF DAM: DRY RUN NO. 101
1



OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: DRY RUN NO. 101 ID# VA 13902

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Dry Run Dam No. 101 (Lake Arrowhead) is a zoned earthfill dam approximately 67 feet high and 2100 feet long. Seepage control is provided by an impervious core, grout curtain and cutoff trench.

The principal spillway is a drop-inlet structure consisting of a reinforced concrete riser, 30 inch diameter reinforced concrete outlet pipe, and a riprap lined stilling basin approximately 60 feet long and 25 feet wide.

The emergency spillway (crest elevation 1151.6 feet M.S.L.), a 375 foot wide, vegetated, side-channel type, is located outside the left abutment of the dam.

A 10 inch corrugated metal pipe (perforated) comprises the seepage drain. The pipe is located downstream of the centerline profile of the dam and exits adjacent to a 30 inch reinforced concrete pipe, which is the main outlet of the principal spillway.

NAME OF DAM: DRY RUN NO. 101

The reservoir is used for flood control and was designed for future water supply. There is a side-inlet on the riser with an invert elevation of 1142.6 feet M.S.L. which controls normal pool elevation and a high-stage riser crest at an elevation of 1146.3 feet M.S.L. Six manually operated gate valves allow intake to a 16 inch diameter cast-iron water supply pipe, which flares to 18 inch diameter where it exits. The 30 inch slide gate anchored on the upstream face of the riser, which has an invert elevation of 1101.6 feet M.S.L., can be used to drain the reservoir. The plan and typical sections of the dam are given on Plates 1, 2 and 3.

1.2.2 Location: Dry Run Dam No. 101 is located on Dry Run approximately 3 miles southeast of the Town of Luray in Page County, Virginia. A Location Plan is included in this report.

1.2.3 Size Classification: The maximum height of the dam is 67 feet and the reservoir storage capacity to the top of dam elevation is 1232 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: Due to the proximity of the Town of Luray with a population of 3800, many lives could be lost in the event of failure of the dam. Therefore, this dam is considered in the "high" hazard category as defined by Section 2.1.2 of the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned and operated by the Town of Luray, Page County, Virginia with maintenance assistance from the Shenandoah Valley Soil and Water Conservation District and the regional U.S. Soil Conservation Service (SCS).

1.2.6 Purpose of Dam: The dam is used for flood control purposes within the Potomac River Basin.

1.2.7 Design and Construction History: The existing facility was designed for the owner by the SCS. The dam, completed in June 1971, was built by the English Construction Co., Inc.

1.2.8 Normal Operational Procedures: No formal operational procedures are followed for this dam. Normal pool is maintained by an inlet on one side of the riser with an invert elevation of 1142.60 feet M.S.L. Since the dam is multipurpose, flood control and future water supply, the principal spillway (riser) crest is located at an elevation of 1146.3 feet M.S.L. with excess flow diverted through the emergency spillway which has a crest elevation of 1151.60 feet M.S.L. It is not known how frequently the 30 inch slide gate has been operated.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area of Dry Run Dam No. 101 is 2.62 square miles.

1.3.2 Discharge at Dam Site: The maximum flow at the dam site through the spillway is unknown.

Principal Spillway:

Pool level at emergency						
spillway crest						134 c.f.s.
Pool level at top of dam . . .						141 c.f.s.

Emergency Spillway:

Pool level at top of dam . .	15,540 c.f.s.
------------------------------	---------------

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Reservoir Capacity			
		Area acres	Acre- feet(a)	Watershed inches	Length feet
Top of dam	1157.6	56.4	1232	8.82	1300
Maximum pool, design surcharge	1154.0	51.0	1032	7.39	-
Emergency spillway crest	1151.6	47.0	922	7.10	1100
Principal spillway crest	1146.3	39.0	692	4.95	-
Normal pool (b)	1142.6	33.8	552	3.95	800
Streambed at centerline of dam	1090.4	-	-	-	-

(a) Total storage, includes 102 acre-feet of sediment storage.
(b) Invert of low-level intake to riser.

NAME OF DAM: DRY RUN NO. 101

SECTION 2 - ENGINEERING DATA

2.1 Design: The design data reviewed included the following:

- 1) As-built drawings indicating plans, elevations and sections of the dam and appurtenant structures. Logs of test borings and test pits were also included in the as-built drawings. Plan and typical sections as taken from the as-built drawings are included as Plates 1, 2 and 3 in Appendix I.
- 2) Hydrologic and hydraulic data including outlet discharge capacity, reservoir area and storage capacity, and hydrograph and routing determinations for principal spillway, the emergency spillway and the freeboard hydrographs.
- 3) Annual Maintenance Inspection Reports for the past five years conducted by the Town of Luray with assistance from the Shenandoah Valley Soil and Water Conservation District and the regional SCS office (see Appendix V).

All design data was obtained from the SCS and has been filed with the Norfolk District for future reference.

2.2 Construction: The dam, constructed by the English Construction Company, Inc., was completed in June 1971. Construction records were not available for this inspection; however, as-built drawings were reviewed and were verified in the field. Construction records are on file in Washington, District of Columbia.

2.3 Operation: There are no formal operational procedures for this dam. It is not known how regularly the slide gate is operated. Annual maintenance inspections are conducted by the Town of Luray with the assistance of the Shenandoah Valley Soil and Water Conservation District and the regional SCS office.

2.4 Evaluation

2.4.1 Design: The as-built drawings were adequate to assess the structural stability of the dam. The hydrologic and hydraulic data provided was adequate for design review. The as-built drawings show a relatively thin, impervious core section. Foundation conditions were determined by using the subsurface data presented in the as-built drawings.

NAME OF DAM: DRY RUN NO. 101

2.4.2 Construction: No construction logs were available for review; however, as-built drawings do indicate modifications and changes made during construction.

2.4.3 Operation: Annual inspection reports were available for review and are included in Appendix V.

NAME OF DAM: DRY RUN NO. 101

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field investigation was conducted on 14 November 1978. No unusual weather conditions were experienced and the reservoir was at normal pool elevation. The dam and appurtenant structures were found to be in good overall condition at the time of the inspection. The problems noted during the visual inspection are considered to be minor and do not require immediate remedial treatment. Significant deficiencies are described briefly in the following paragraphs. The complete visual inspection check list is given in Appendix III.

3.1.2 Dam: The embankment was in good physical condition. No cracks, unusual movement, sloughing, appreciable erosion or seepage was observed on the embankment or abutments. There are several bare and eroded pathways and a cut slope above the right abutment that should be seeded to prevent increased erosion.

Minor bare areas resulting from vehicular traffic were observed. However, no erosion in these tracks was evident and therefore remedial treatment is not considered necessary at this time.

3.1.3 Appurtenant Structures: Several of the stems to the water supply gates are disconnected or bent (see Photo 1) and would need to be repaired before they could be used for water supply.

3.1.4 Reservoir Area: No serious deficiencies were observed in the reservoir area (see Photos 2 and 3). A staff gage should be installed to monitor reservoir elevations above normal pool.

3.1.5 Downstream Channel: The stilling basin and outlet channel are functioning properly and the riprap is in good condition (see Photo 4).

3.2 Evaluation: None of the above items is serious enough to warrant immediate attention since they do not threaten the integrity of the dam. However, the repair and replacement items are considered to be good maintenance and should be attended to as part of the annual maintenance inspection program.

NAME OF DAM: DRY RUN NO. 101

SECTION 4 - OPERATIONAL PROCEDURES

- 4.1 Procedures: No formal operational procedures are used for Dry Run Dam No. 101, since the dam presently serves only as a flood control structure and does not require operation of its water supply gates and valves at this time. The reservoir remains at normal pool elevation of 1142.6 feet M.S.L., which is maintained by the low-level inlet crest on the riser. There is an additional 9.0 feet of storage to the crest of the emergency spillway at elevation 1151.6 feet M.S.L. The difference in stage is less than typical for single purpose flood control dams because of the dam's design for water supply storage.
- 4.2 Maintenance of Dam: Annual maintenance inspections are performed by the Town of Luray with the assistance of the Shenandoah Valley Soil and Water Conservation District and the regional SCS office. Inspection reports are included in Appendix V.
- 4.3 Maintenance of Operating Facilities: The gate valves on the 16 inch diameter riser pipe are not presently used for water supply. The slide gate is not operated to check for proper functioning.
- 4.4 Warning System: At the present time, there is no warning system or evacuation plan in operation.
- 4.5 Evaluation: Considering the functions presently served by the operational facilities, maintenance is considered adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Normal pool (elevation 1142.6 feet M.S.L.) maintained by a 1 foot high by 4 foot wide orifice on the right (northeast) side of the riser was established at an elevation to store 0.73 watershed inches (100-year sediment) plus an additional 3.23 watershed inches for water supply. The riser crest (elevation 1146.3 feet M.S.L.) was established at an elevation to store an additional 1 inch of floodwater. The capacity (134 c.f.s. with reservoir level at crest of emergency spillway) of the principal spillway was established by consideration of a number of factors including:

- 1) The capability of evacuating the flood storage space within a reasonable time (\pm 10 days).
- 2) Not passing damaging flows downstream.
- 3) The capability of the reservoir to store the floodwaters.

The crest (elevation 1151.6 feet M.S.L.) of the emergency spillway was established at the maximum elevation needed to store the 100-year, 10-day rainfall. The elevation of the top of dam (elevation 1157.6 feet M.S.L.) was established by the maximum elevation reached in passing the freeboard hydrograph. The freeboard hydrograph is that computed from rainfall comparable to Probable Maximum Precipitation (PMP) as used by the Corps of Engineers and is therefore comparable to the Probable Maximum Flood (PMF).

5.2 Hydrologic Records: No rainfall data of stream flow records were available.

5.3 Flood Experience: No exact high water marks were available; however, local citizens stated that water has risen over the top of the riser in the past.

5.4 Flood Potential: Design features of the dam were established by the SCS by routing various hydrographs as noted in Paragraph 5.1.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Except for future water supply, regulation of flow from the reservoir is automatic. Normal flows are maintained by the low stage orifice in the riser at an elevation of 1142.6 feet M.S.L. and the high stage drop-inlet

with a crest of 1146.3 feet M.S.L. Water flowing into the inlets flows through the dam in a 30 inch diameter reinforced concrete conduit. Water also flows past the dam through an ungated, vegetated, side-channel, emergency spillway in the event water in the reservoir rises above the spillway crest (elevation 1151.6 feet M.S.L.).

Outlet discharge capacity, reservoir area and storage capacity, and hydrograph and routing determinations were obtained from reports and computations furnished by the SCS. The routing of the emergency and freeboard hydrographs began with the reservoir level at normal pool.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on the reservoir performance in various hydrographs is shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrographs		
		Principal Spillway (a)	Emergency Spillway	Free- board (b)
Peak flow, c.f.s.				
Inflow	-	-	6833	18,153
Outflow	-	141	3360	15,810
Peak elev., ft. M.S.L.	1142.6	1156.6	1154.0	1157.6
Emergency spillway (elev. 1151.6 ft. M.S.L.)				
Depth of flow, ft.	-	-	2.4	6.0
Avg. velocity, f.p.s.	-	-	6.5	11.0
Non-overflow section (elev. 1157.6 ft. M.S.L.)				
Depth of flow, ft.	-	-	-	-
Duration of over- topping, hrs.	-	-	-	-
Avg. velocity, f.p.s.	-	-	-	-
Tailwater elev., ft. M.S.L. (c)	1191.0	-	-	-

(a) 100-year, 10-day volume produces the most conservatively large indication of flood control storage required. Detailed discharge hydrograph was not determined.
 (b) PMF by COE standards.
 (c) Tailwater at time of inspection.

NAME OF DAM: DRY RUN NO. 101

5.7 Reservoir Emptying Potential: The time to drawdown the reservoir level from the crest of the emergency spillway (discharge of 134 c.f.s.) to the crest of the riser (discharge of 37 c.f.s.) is about 1.1 days. While the time to draw the reservoir down from the riser crest to the orifice crest is about 8.2 days. With the 30 inch diameter reservoir drain opened, the reservoir can be drained from normal pool to elevation 1101.6 feet M.S.L. in about 2.7 days. Reservoir drawdown was estimated neglecting inflow.

5.8 Evaluation: Hydrologic and hydraulic determinations of the project as prepared by the SCS appear reasonable. The dam and spillway are designed to pass a flood essentially equal to PMF which would be developed under standards used by the Corps of Engineers. The project will pass the PMF without overtopping the dam.

Conclusions pertain to present day conditions and the effect of the future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The foundation of the dam consists of 7 to 28 feet of clayey and silty sands with gravel and boulders overlying hard, cross-bedded, argillaceous sandstone with traces of shale and quartzite. The cutoff trench provided for seepage control extends to the weathered bedrock. Both abutments are composed of a relatively thin mantle of silty sand and rock fragments above gray and brown cross bedded sandstone.

6.2 Stability Analysis

6.2.1 Visual Observations: No evidence of instability in the embankment, cut slopes or concrete structures was observed. No seepage was observed in the embankment, abutments or foundation.

6.2.2 Design Data: No data was available that included stability analyses.

6.2.3 Operating Records: Recent annual maintenance inspection reports indicate that there are no serious deteriorative conditions except for minor erosion. High water marks on the upstream slope show that the level of the reservoir has risen several feet above the normal pool elevation without any significant damage.

6.2.4 Post-Construction Changes: No alterations of the dam since it has been constructed were apparent.

6.2.5 Seismic Stability: Dry Run Dam No. 101 is located in Seismic Zone 2, and is considered to have no hazard from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: Stability analyses of the dam were not available. However, a study of the as-built drawings, the field observations, and field studies indicates no serious distressed external conditions which would suggest instability of the structure.

NAME OF DAM: DRY RUN NO. 101

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The dam, as designed, will not be overtopped under PMF conditions. The hydrologic and hydraulic data available were sufficient to evaluate the spillway capacity. No evidence of seepage or embankment distress were observed. Design reports for soils, foundations, and stabilities were not available for review.

The dam is generally in good condition with the exception of minor maintenance items.

7.2 Recommended Remedial Measures: The inspection revealed certain preventative maintenance items which should be scheduled during the annual maintenance period. These are:

- 1) Remove all large logs and debris located in the reservoir area to prevent clogging of the intakes.
- 2) All bare areas and footpaths on the embankment should be reseeded to prevent erosion.
- 3) A staff gage should be installed to monitor reservoir elevations above normal pool.

APPENDIX I

PLATES

CONTENTS

Location Plan

Plate 1: Plan - Dam and Emergency Spillway

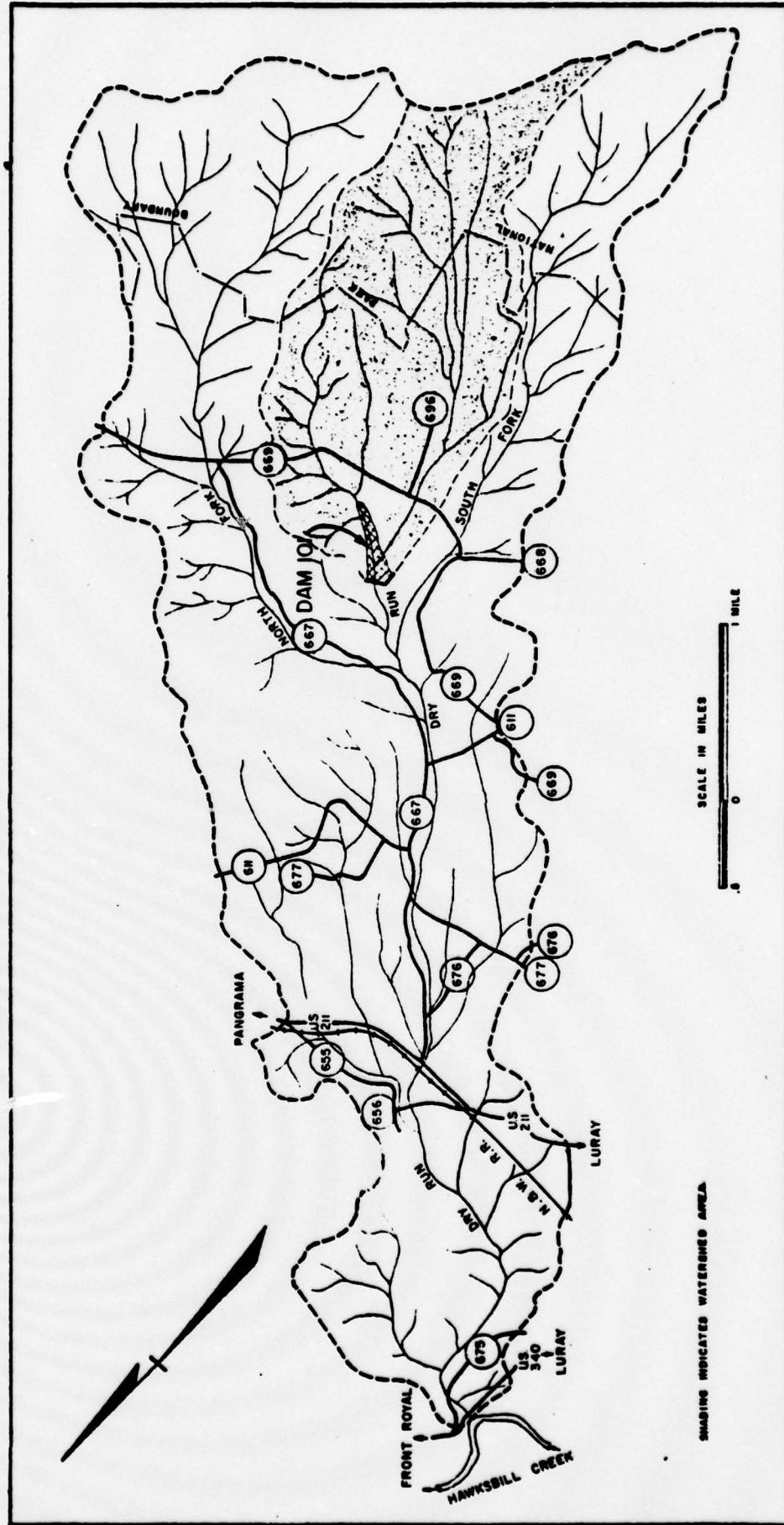
**Plate 2: Plan and Section - Principal Spillway
and Water Supply Line**

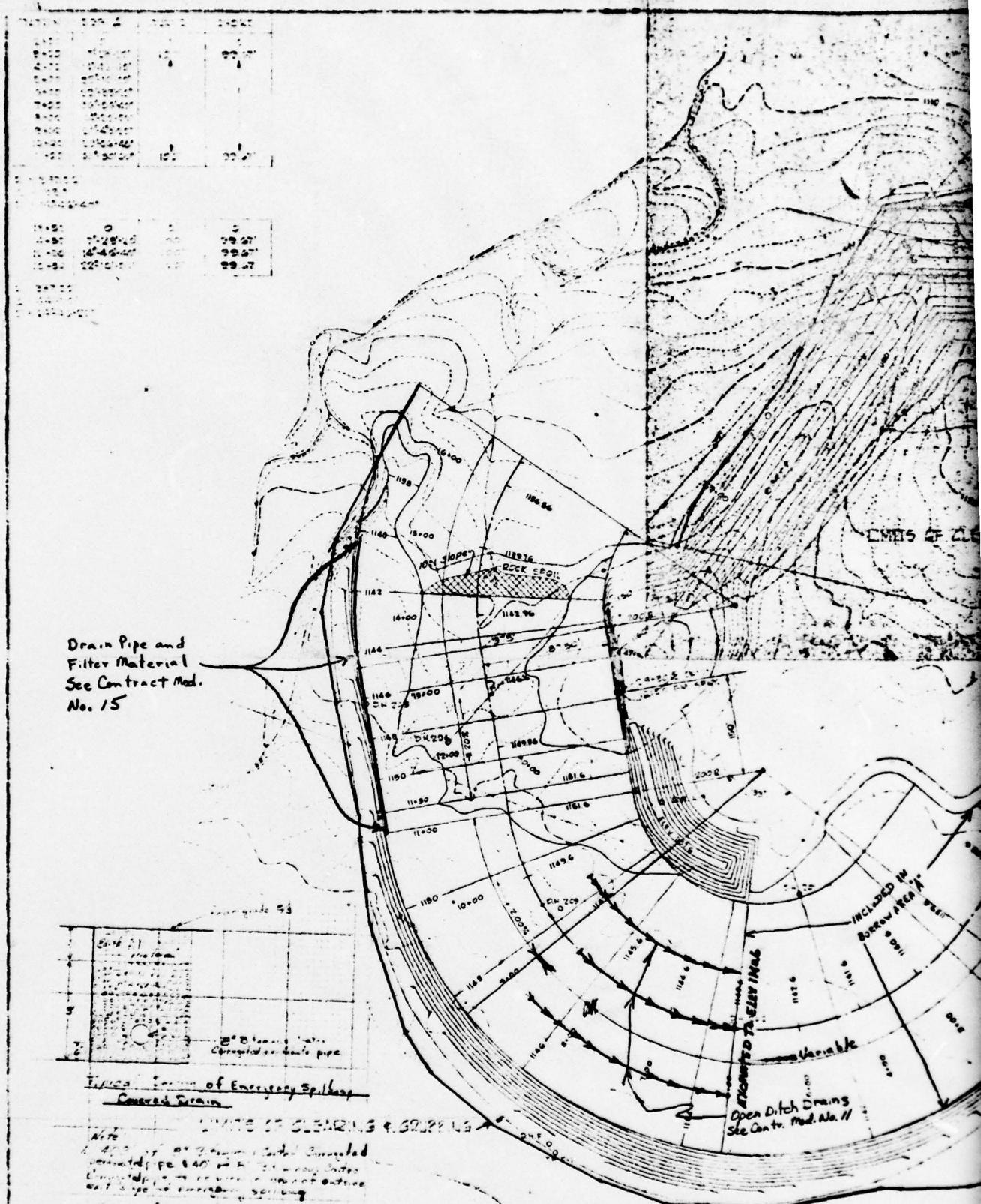
Plate 3: Typical Sections of Dam

NAME OF DAM: DRY RUN NO. 101

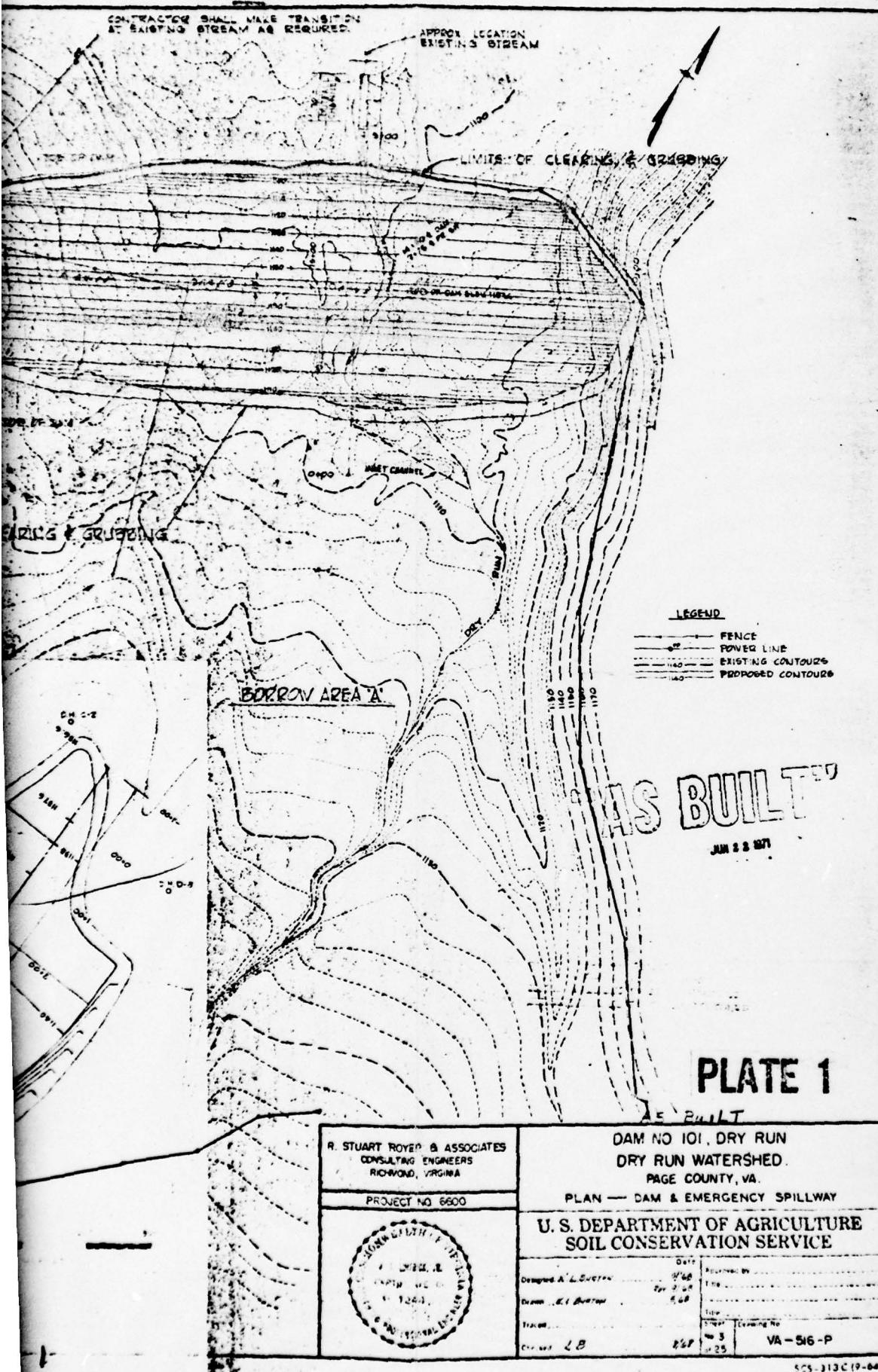
LOCATION PLAN
DRY RUN DAM NO. 101

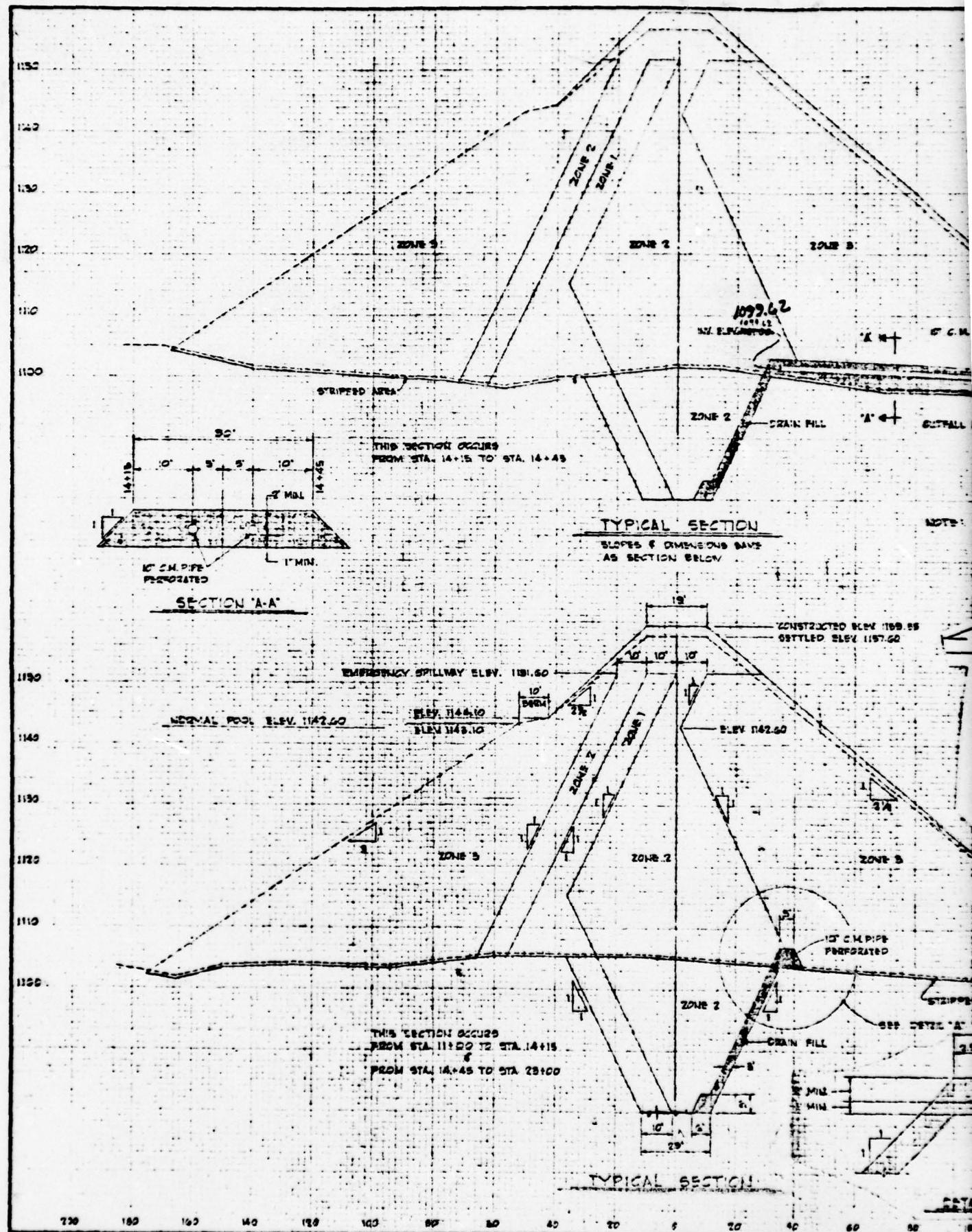
A map of Virginia with a wavy line representing the state border. A small black dot is marked on the western side of the state, indicating the location of Dry Run Dam No. 101. The label "VA." is written to the right of the state border.





Drain Pipe and
Filter Material
See Contract Mod.
No. 15



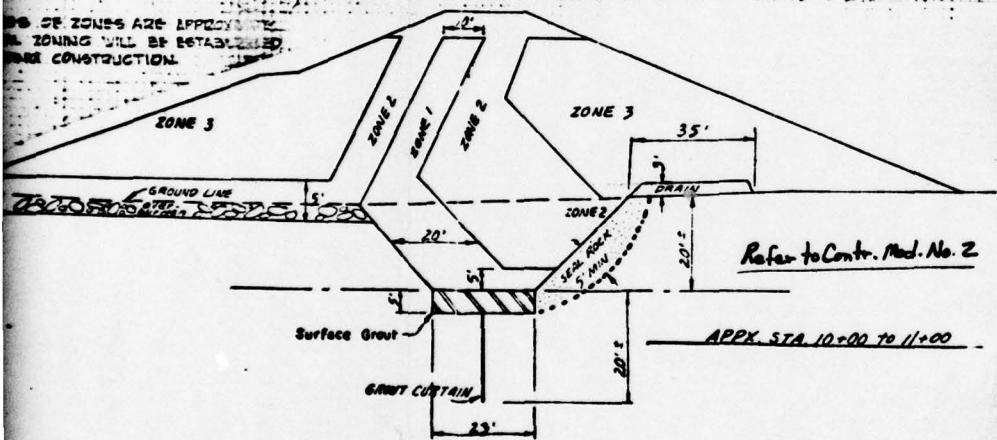


Design	Filter	Material
Stove	4.5	Possibly
30		300
40		60-120
1 1/2"		50-100
10		30-160
3/4"		30-90
1/2"		40-90
3/8"		8-9
1/4"		4-32
60		0-0
800		0-5
200		0-5

EARTH FILL REQUIREMENTS						
Item	Material	Max. Bulk Density (lb/ft ³)	Max. Liquid Limit (%)	Required water content	Compaction (%)	Classification (3)
1	CL-ML material from borrow area <u>B</u> as shown on sheet <u>4</u>	3	3	32 to 36 % optimum	A	100% of max. consist by AT 100% Material A
2	Material from borrow area <u>A</u> , emergency spillway, and excavation common represented by T.R. 3-1 from <u>0.1</u> to <u>0.5</u>	3	18	See Spec. SA	V	See Spec. SA
3	Material from borrow area <u>A</u> , emergency spillway, excavation common, and overfilled material from zone 2.	30	36	See Spec. SA	V	See Spec. SA

(1) For fill adjacent to structures, max. rock size = 30
 (2) at time of placement
 (3) For typical compaction curves see Sheet 1a

NO SP ZONES ARE APPROVED
TIL ZONING WILL BE ESTABLISHED
DUE CONSTRUCTION



DRY RUN SITE 101

- 1.) Drill and grout (3) angle holes in a section at the intersection of the right abutment and the floodplain (STA 11+00) on 20' centers. Angles to be 30° to 45° from vertical directed along the dam axis.
- 2.) The cutoff trench is to be backfilled as shown and the downstream face of the slope sealed by grouting from the surface of the trench backfill. The blanket drain will then be installed as shown.
- 3.) ~~overburden~~ on upstream side from STA 10+00 to 11+00 to be removed and replaced with zone 2 material as shown.

2020-03-197

PLATE 3 "AS BUILT"

R. STUART ROYER & ASSOCIATES
CONSULTING ENGINEERS
RICHMOND, VIRGINIA

DAM NO. 101, DRY RUN
DRY RUN WATERSHED
PAGE COUNTY, VA.
TYPICAL SECTIONS OF DAM

**U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**



REGISTRATION

5.00

THE BOSTONIAN

Orson K. L. Button

250 7/68
5/68

• 100 •

1888-48

8/68 7 W

VA - 516 - F

2

APPENDIX II

PHOTOGRAPHS

CONTENTS

- Photo 1: Riser's Lift Pedestal, Gate Stems
and High Stage Trash Rack**
- Photo 2: Reservoir Area and Riser**
- Photo 3: Emergency Spillway and Left Abutment**
- Photo 4: Outlet Pipe and Stilling Basin**

Note: Photographs were taken 14 November 1978.

NAME OF DAM: DRY RUN NO. 101

DRY RUN DAM No. 101

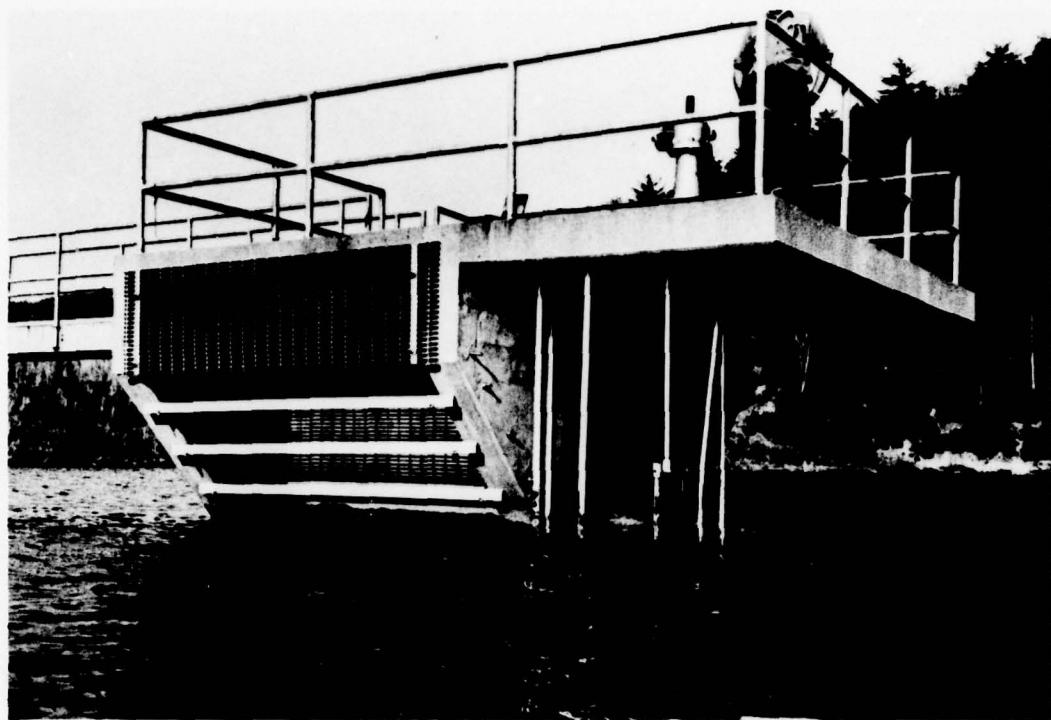


PHOTO 1. Riser's Lift Pedestal, Gate Stems and High Stage Trash Rack



PHOTO 2. Reservoir Area and Riser

DRY RUN DAM No. 101



PHOTO 3. Emergency Spillway in Left Abutment



PHOTO 4. Outlet Pipe and Stilling Basin

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name of Dam Dry Run No. 101 County Page State Virginia Coordinates Lat. 3838.5
Long. 7823.5

Date Inspection 14 November 1978 Weather Sunny, Warm Temperature 70°F.

Pool Elevation at Time of Inspection 1142.5 ft. M.S.L. Tailwater at Time of Inspection 1191.0 ft. M.S.L.

III-1

Inspection Personnel: Michael Baker, Jr., Inc.: Soil Conservation Service:
T. W. Smith
T. J. Dougan
W. L. Sheaffer

Sam Linkenhoker

T. W. Smith Recorder

EMBANKMENT		REMARKS OR RECOMMENDATIONS	
VISUAL EXAMINATION OF		OBSERVATIONS	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE		None observed.	
SURFACE CRACKS		None observed.	
SLoughing or Erosion of Embankment and Abutment Slopes	III-2	No sloughing was observed on embankment and abutment slopes. Minor erosion occurs in a path on upstream slope at the riser walkway and on a path at the end of the dam adjacent to the inlet of emergency spillway. The slope in a cut at the right abutment has sparse vegetation. The soil is exposed in tire tracks on the crest. There is no appreciable erosion. The dam has a thick vegetative cover.	Grass seeding is recommended for the bare areas.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST		Good	
RIPRAP FAILURES		There is no riprap on the embankment.	
SLOPES		The downstream and upper part of the upstream slope above the 10 ft. wide berm were constructed at a 2.5:1 ratio. The upstream slope below the normal pool elevation at the level of a 10 ft. wide berm was formed at a 3:1 ratio. There is minor scattered wood debris on the lower upstream slope.	It is recommended that the debris be removed periodically.

EMBANKMENT

Name of Dam: DRY RUN NO. 101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPE AND FILL MATERIAL	According to the as-built drawings, the embankment was constructed in 3 zones including CL-M. clay-silt core and a cut-off trench. The soils observed on the surface of the dam are generally comprised of brown-damp-dense silty sand, gravel, cobbles and rock fragments. According to the as-built drawings and boring logs, the soils in Zones 2 and 3 consist of clayey and silty sand with gravel, cobbles and boulders. Zone 3 also has oversize material. Traces of wood debris have been left by high water on the upstream slope.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The right abutment consists of a 1.5:1 slope of silty sand and rock fragments with two 4 x 4 ft. benches cut in the hill above the crest of the dam. Hard arkosic sandstone of the Erwin (Antietam) formation in the Cambrian System is partially exposed with boulders on the downstream slope of the hill on the right side in a wooded area. The left side abuts against a small quartzite ridge mostly covered with a thin mantle of silty sand and rock fragments. The embankment is extended on the southeast side of the ridge adjacent to the emergency spillway.	
ANY NOTICEABLE SEEPAGE	No seepage was observed on the downstream slope or in the vicinity of the downstream toe.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	Two 10 in. C.M.P. are located on either side of outlet conduit. No flow was observed from either drain at the time of inspection.	

Name of Dam: DRY RUN NO. 101

EMBANKMENT

Sheet 3

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
FOUNDATION	According to the as-built drawings, the embankment is constructed on a river floodplain 10 to 28 ft. deep. The deposits consist of silty sand and gravel with boulders over hard cross-bedded argillaceous sandstone with traces of shale (based on the boring logs). A ridge of white very hard quartzite is partially exposed near the downstream toe where the dam curves. The cutoff trench to bedrock was grouted as indicated in the as-built drawings.	

Name of Dam: DRY RUN NO. 101

OUTLET WORKS

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No cracking or spalling of the outlet conduit was observed.	
INTAKE STRUCTURE	Concrete riser with a 1 x 4 ft. orifice controlling normal pool. Also has a high stage orifice approximately 3.7 ft. above orifice invert. Top of riser has one lift and pedestal for the 30 in. slide gate. Also has 6 gates that can be operated from riser for future water supply.	Several of the stems to the water supply gates are disconnected or bent and would need repair before they could be used for water supply.
OUTLET STRUCTURE	Consists of a 30 inch C.M.P. encased in concrete extending through the embankment and exiting in the stilling pool. Flow was measured at 0.7 g.p.m.	
OUTLET CHANNEL	The outlet channel consists of a stilling pool approximately 25 ft. wide and 60 ft. long with limestone riprap bank protection.	
EMERGENCY GATE	Located on riser and can be used to drain reservoir (30 in. slide gate). Not operated periodically as far as can be determined.	Should be operated periodically to check for proper functioning.

Name of Dam: DRY RUN NO. 101

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None	
APPROACH CHANNEL	<p>Emergency spillway has an adverse slope to a control section approximately 460 ft. wide. There are 3 small watercourses in the channel which collect clear seepage from the cut and outlet into the reservoir. The channel is cut into silt, sand, gravel, cobbles and rock fragments. There is a good grass cover.</p>	
DISCHARGE CHANNEL	<p>Emergency spillway discharges downstream with a slope of approximately 3% across a stone road into a swale in the woods adjacent to a farm. The channel consists of silt, sand, gravel, cobbles and rock fragments.</p>	
BRIDGE AND PIERS	None	
CONFINING SLOPES	<p>The slope on the left is cut a maximum of 25 ft. deep at a ratio of 3:1 with grass cover in brown damp to moist silty sand, gravel, cobbles and rock fragments. There is some scattered clear seepage at the base which is collected in a ditch. The right slope consists of an extension of the dam (damp silty sand, gravel and rock fragments) and a small quartzite ridge with a cover of silty sand and rock fragments.</p>	

INSTRUMENTATION		
NAME OF DAM:	DRY RUN NO.	101
VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None	
PIEZOMETERS	None	
OTHER		

Name of Dam: DRY RUN NO. 101

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The forest covered slope is moderately steep. The soil consists of damp, light-brown, silty sand and rock fragments. There are very few exposures of bedrock.	
SEDIMENTATION	No unusual sedimentation was noted.	

Name of Dam: DRY RUN NO. 101

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The stream channel is comprised of sand, gravel, cobbles and small boulders with some vegetation growing beside it. There are no significant obstructions or debris.	
SLOPES	The shallow slopes consist of silty sand, gravel, cobbles and boulders.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 500 ft. downstream of the dam is a farm house. Another 40 to 50 homes are located in the stream valley primarily along Rt. 667 for the next 3 mi. downstream. Population is estimated to be around 200 to 300.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN. CONSTRUCTION. OPERATION

Name of Dam: DRY RUN NO. 101

BREVIER

PLAN OF DAM The Plan of Dam is shown on the as-built drawings.

REGIONAL VICINITY MAP The vicinity map is presented in this report as the location plan.

CONSTRUCTION HISTORY The contractor and completion date were obtained from the COE. The dam was constructed by the English Construction Company in 1971.

TYPICAL SECTIONS OF DAM

Hydrologic data and hydrologic calculations were available.

OUTLETS - PLAN and DETAILS Shown on as-built drawings.

- CONSTRAINTS and DISCHARGE RATINGS Contained in the hydrologic/hydraulic calculations.

RAINFALL/RESERVOIR RECORDS No rainfall or reservoir records are available at the dam.

Name of Dam: DRY RUN NO. 101

ITEM	REMARKS
------	---------

DESIGN REPORTS A Design Report was not available for this inspection report.

GEOLOGY REPORTS A Geologic Report was not available for this inspection.

DESIGN COMPUTATIONS	Hydrology and hydraulic calculations were available for this inspection report.
HYDROLOGY & HYDRAULICS	Stability analyses were not available.
DAM STABILITY	
SEEPAGE STUDIES	

MATERIALS INVESTIGATIONS	Boring and test pit records and dry density compaction curves for soils in the 3 zones of the dam are presented in the as-built drawings.
BORING RECORDS	
LABORATORY	
FIELD	

POST-CONSTRUCTION SURVEYS OF DAM No known post-construction surveys were found.

BORROW SOURCES Borrow areas in the reservoir area and south of the emergency spillway are shown in the as-builts.

Name of Dam: DRY RUN NO. 101

<u>ITEM</u>	<u>REMARKS</u>
MONITORING SYSTEMS	No monitoring systems have been provided.
MODIFICATIONS	Data obtained during inspection agrees very closely with as-built drawings indicating that no major modifications were made.
HIGH POOL RECORDS	None are available. Local citizens indicated that water has riser over the top of the riser in the past.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None are available.
PRIOR ACCIDENTS OR FAILURE OF DAM	No prior accidents or failure of the dam have been noted.
DESCRIPTION REPORTS	
MAINTENANCE	Annual inspections are conducted by the Town of Luray with the assistance of the Shenandoah
OPERATION	Valley Soil and Water Conservation District and the SCS to make recommendations for maintenance
RECORDS	and upgrading of the dam if needed.

Name of Dam: DRY RUN NO. 101

<u>ITEM</u>	<u>REMARKS</u>
SPILLWAY PLAN	
SECTIONS and DETAILS	Information contained in the as-built drawings.

OPERATING EQUIPMENT
PLANS & DETAILS

Information contained in the as-built drawings.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 2.62 sq.mi. 1142.6 ft. M.S.L.

EL E V A T I O N T O P E M E R G E N C Y S P I L L W A Y C R E S T

EL E V A T I O N T O P E M E R G E N C Y S P I L L W A Y C R E S T
(STORAGE CAPACITY): 1151.6 ft. M.S.L. (922 ac.-ft.)

EL E V A T I O N M A X I M U M D E S I G N P O O L : 1154.0 ft. M.S.L.

EL E V A T I O N T O P D A M: 1157.6 ft. M.S.L. (settled)

CREST: Emergency Spillway

a. Elevation 1151.6 ft. M.S.L.
b. Type Earth side-channel with vegetative cover
c. Width 375 ft.
d. Length 830 ft. total length (500 ft. approach, 30 ft. Level
section, 300 ft. exit)
e. Location Outside left abutment
f. Number and Type of Gates None

OUTLET WORKS: _____

- a. Type Drop-inlet concrete riser
- b. Location Riser in reservoir with 30 in. diameter reinforced concrete outlet pipe
- c. Entrance inverts 1142.6 ft. M.S.L. (normal pool)
- d. Exit inverts 1093.0 ft. M.S.L. (30 in. diameter outlet pipe)
- e. Emergency draindown facilities reservoir drain (30 in. diameter slide gate)

HYDROMETEOROLOGICAL GAGES: None available

a. Type _____
b. Location _____
c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE **Unknown**

Name of Dam: DRY RUN NO. 101

APPENDIX V

ANNUAL MAINTENANCE INSPECTION REPORTS

REPORT ON ANNUAL MAINTENANCE INSPECTION OF
DRY RUN WATERSHED FLOOD CONTROL STRUCTURES

The Shenandoah Valley Soil and Water Conservation District performed their annual inspection of the completed flood water retarding structures on the Dry Run Watershed, in Page County, Virginia May 23, 1978. The structures inspected were dams 101 and 102. District Director Arlis Frymyer performed the inspection with the assistance of Don Smith, Luray Town Manager and Sam Linkenhoker, District Conservationist.

The results of the inspections are listed below as agreed to maintenance items.

Dam 101 (Lake Arrowhead)

1. Remove small cedars on downslope of dam.
2. Remove brush from knoll on eastern end of dam and spray undergrowth with brush killer and oil.
3. Spray and remove small trees on drainage ditches in the spillway.
4. Replace bolts on walkway structure.

Dam 102 (Lake Morning Star)

1. Paint a large warning (DANGER KEEP OUT) on the exit end of the principal spillway pipe.

Damaged areas on Dam 102, as a result of motor vehicles, had been repaired and appeared in excellent condition with seeding and planking.

Arlis Frymyer
Arlis Frymyer, Director

Donald Smith, Town Manager

Samuel W. Linkenhoker
Samuel W. Linkenhoker,
District Conservationist

REPORT OF ANNUAL MAINTENANCE INSPECTION OF
DRY RUN WATERSHED FLOOD CONTROL STRUCTURES

The Shenandoah Valley Soil and Water Conservation District performed their annual inspection of the completed flood water retarding structures on the Dry Run Watershed, in Page County Virginia April 21, 1977. The structures inspected were dams 101 and 102. District directors Joyce Burner and Clark Spitler performed the inspection with the assistance of Don Smith, Luray Town Manager and Sam Linkenhoker, District Conservationist.

The results of the inspections are listed below as agreed to maintenance items.

Dam 101 (Lake Arrowhead)

1. Remove brush and trees from the upstream slope of dam and paint the stumps with Brush-Killer and oil.
2. Remove the common mullein (*Verbascum thapsus*) from the slopes of the dam and spillway by either grubbing or spraying with 2,4-D mixed in common detergent.
3. Spray the brush on the slopes of the spillway with Brush-Killer.
4. Install a post in the existing lane which is located around the southern edge of the lake to prohibit vehicular travel on said lane.
5. Remove all downed trees that are located within the flood pool area.

Dam 102 (Lake Loring Star)

1. Paint a large warning (DANGER KEEP OUT) on the exit end of the principal spillway pipe.
2. Remove all locust sprouts from the back side of the dam and paint the stumps with Brush-Killer and fuel oil.

Clark W. Spitler
Clark Spitler, Director

Joyce P. Burner
Joyce Burner, Director

Donald Smith
Donald Smith, Town Manager

SHENANDOAH VALLEY SOIL AND WATER CONSERVATION DISTRICT
REPORT OF ANNUAL MAINTENANCE INSPECTION OF WATERSHED DAMS IN

DRY RUN WATERSHED PROGRAM

May 27, 1976

Inspection of the dams on Dry Run, Page County, Virginia was made May 27, 1976 by Clark Spitler, Martha Ann Atwood, and Joyce Burner, Shenandoah Valley Soil and Water Conservation District Directors. They were assisted by Donald Smith, Town Manager, and Jimmie Griffith, Water Superintendent, Town of Luray. The group was accompanied by John D. Crist, Soil Conservation Service.

The following corrections were agreed upon by all parties involved:

Dam No. 102 - 1. Remove locust and willow trees from dam and spillway and paint stumps with 245T and fuel oil.
2. Remove log from floodpool area.
3. Paint sign on drain pipe at stilling pool to keep people out of pipe. Danger, Keep Out, Town of Luray.

Dam No. 101 - 1. Remove locust and willow trees from dam and spillway and paint stumps with 245T and fuel oil.
2. Remove large logs from dam and waterline.

This report is concurred by:

Clark W. Spitler
Clark Spitler, Director
Shenandoah Valley Soil and Water Conservation District

Martha Ann Atwood
Martha Ann Atwood, Director
Shenandoah Valley Soil and Water Conservation District

Joyce P. Burner
Joyce Burner, Director
Shenandoah Valley Soil and Water Conservation District

Donald A. Smith
Donald Smith, Town Manager Town of Luray

Jimmie Griffith
Jimmie Griffith, Water Superintendent Town of Luray

John D. Crist
John D. Crist, District Conservationist
Soil Conservation Service

DISTR: State Office 2 cys.
Area Office
Luray Field Office
Town of Luray
Shenandoah Valley SAWCD

SHENANDOAH VALLEY SOIL AND WATER CONSERVATION DISTRICT
REPORT OF ANNUAL MAINTENANCE INSPECTION OF WATERSHED DAMS IN

DRY RUN WATERSHED PROGRAM

May 8, 1975

Inspection of the dams on Dry Run, Page County, Virginia was made May 8, 1975 by Clark Spitler, Shenandoah Valley Soil and Water Conservation District Director. He was assisted by Dempsey Stokes and Haywood Nichols from the Town of Luray and John D. Crist, Soil Conservation Service.

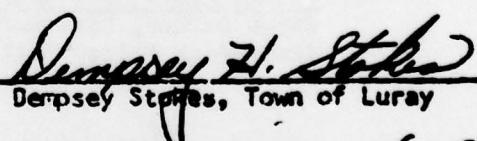
The following corrections were agreed upon by all parties involved:

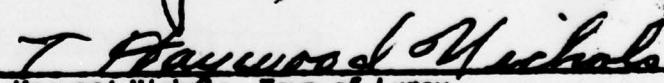
Dam No. 101 - 1. All small locust on dam and spillway will be cut and sprayed with 245T and fuel oil.
2. The larger logs will be removed from the dam to prevent clogging of spillway.
3. Two small galled areas will be seeded to Ky. 31 fescue and mulched with straw.

Dam No. 102 - 1. All small locusts on the dam and spillway will be cut and sprayed with 245T and fuel oil.
2. Two small galled areas will be seeded to Ky. 31 fescue and mulched with straw. The overhang on the top galled area will be knocked off and the area planted to locust to hold the sod in place.

This report is concurred by:


Clark Spitler, Shenandoah Valley Soil and Water
Conservation District Director


Dempsey Stokes, Town of Luray


Haywood Nichols, Town of Luray


John D. Crist, District Conservationist, Soil
Conservation Service

DISTR: State Office 2 cys.
Area Office
Luray Field Office
Town of Luray
Shenandoah Valley SWCD

SHENANDOAH VALLEY SOIL AND WATER CONSERVATION DISTRICT
REPORT OF ANNUAL MAINTENANCE INSPECTION OF WATERSHED DAMS IN
DRY RUN WATERSHED PROGRAM

April 4, 1974

Inspection of the dams was made April 4, 1974 by James Aleahire and Clark Spitzer along with other members of the Shenandoah Valley Soil and Water Conservation District Board of Directors. Dempsey Stokes and Tom Speake from the Town of Luray and William L. Blain, Jr. and John Crist from SCS accompanied the inspection team.

The following conditions were reported:

Dam No. 101 - Good condition, no extra maintenance is needed.

Dam No. 102 - Good condition, no maintenance needed.

The report is concurred by:

James E. Aleahire
James Aleahire, Director, Shenandoah Valley Soil
and Water Conservation District

Clark W. Spitzer
Clark Spitzer, Director, Shenandoah Valley Soil
and Water Conservation District

Dempsey L. Stokes
Dempsey Stokes, Town Manager of Luray, Virginia

Thomas E. Speake
Tom Speake, Town Mayor of Luray, Virginia

William L. Blain, Jr.
William L. Blain, Jr., Area Conservationist, SCS

John D. Crist
John D. Crist, District Conservationist, SCS

STSP: State Office 2 cys.
Area 265
Luray Fire & Office
Town of Luray
Shenandoah Valley SWCD

APPENDIX VI

REFERENCES

REFERENCES

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11. U.S. Department of Commerce, "Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years," Weather Bureau, Washington, D.C., May 1961.

NAME OF DAM: DRY RUN NO. 101

VI-1